CLAIMS

1. A method of spectral analysis of a radio frequency ultrasonic signal returned from a structure subjected to an ultrasound examination, comprising the phases of:

a) transmitting an ultrasonic excitation signal to a portion of said structure subjected to examination;

b) receiving a radio frequency response signal from said structure;

c) applying a sequence of filtering operations to obtain decomposition of the band of the radio frequency response signal into a plurality of frequency bands;

d) from the coefficients resulting from said filtering operation, calculating local estimators (a_{ij}, c_{ij}), containing information on the spectrum of the radio frequency signal;

characterized in that said local estimators (a_{ij}; c_{ij}) are combined with parameters (σ_{ij}) representative of the shape of a statistical distribution of said local estimators into a portion of an ultrasound image.

2. Method as claimed in claim 1, wherein the frequency bands into which said radio frequency signal is subdivided cover the entire frequency band of the signal.

3. Method as claimed in claim 1 or 2, wherein said frequency bands are bands of different width and position.

4. Method as claimed in one or more of the previous claims, comprising the phases of:

- for an ultrasound input frame, producing a sampled and digitized frame;
- decomposing said sampled and digitized frame into said frequency bands;
- producing a matrix of spectral coefficients containing the coefficients resulting from said filtering operation or coefficients deriving therefrom;
- determining, for at least some of the points of the sampled and digitized frame, respective interpolating polynomials (PI) which approximate the variation of said spectral coefficients in the various bands into which the radio frequency signal was decomposed;
- for said points, obtaining said local estimators (a_{ij}; c_{ij}) from at least one of the coefficients ($a_0,\dots a_k$) of the interpolating polynomial, said local

estimators constituting a matrix of local estimators.

5. Method as claimed in claim 4, wherein each of said local estimators (a_{ij}) is constituted by one of the coefficients of the respective interpolating polynomial.

6. Method as claimed in claim 4, wherein at least two local estimators ($a_{ij}^{(k)}$) are determined for each point on the basis of at least two coefficients of the interpolating polynomial, to produce a three-dimensional matrix of local estimators ($a_{ij}^{(k)}$).

7. Method as claimed in claim 4, wherein each of said local estimators (c_{ij}) is constituted by a combination of a plurality of coefficients of the corresponding interpolating polynomial.

8. Method as claimed in claim 4, 5, 6 or 7, wherein each of said local estimators (a_{ij}; c_{ij}) is combined with a shape coefficient (σ_{ij}) of a distribution histogram of said local estimators in a window inside which said local estimator is contained, to obtain a weighted local estimator (b_{ij}).

9. Method as claimed in claim 8, comprising the phases of:

- determining a statistical distribution of said local estimators (a_{ij}, c_{ij}) in windows with dimensions smaller than the dimension of said matrix of local estimators (a_{ij}, c_{ij});
- determining a shape parameter (σ_{ij}) characteristic of said statistical distribution for each of said windows;
- for each window, combining said shape parameter (σ_{ij}) with a corresponding local estimator (a_{ij}; c_{ij}) to obtain a weighted local estimator (b_{ij}).

10. Method as claimed in one or more of claims 4 to 9, wherein several weighted local estimators obtained for the same point of the sampled and digitized ultrasound frame using different coefficients ($a_0, \ldots a_k$) of the respective interpolating polynomial are combined with one another.

11. Method as claimed in one or more of the previous claims, wherein said filtering operations are obtained using a time-frequency transform.

12. Method as claimed in claim 11, wherein said time-frequency transform is a wavelet.

13. Method as claimed in claim 11, wherein said time-frequency transform is a Discrete Wavelet Packet Transform (DWPT).

14. Method as claimed in one or more of the previous claims, comprising the phase to determine statistical distribution of the weighted local estimators and to create a set of classes of values capable of bi-univocally identifying homogeneous portions on the ultrasound frame of the investigated sample.

15. Method as claimed in one or more of the previous claims, wherein color images produced using said weighted local estimators are overlaid on an ultrasound image.

16. Method as claimed in claim 15, wherein said color images are produced selecting the weighted local estimators that fall within classes of reference, bi-univocally related to predetermined tissue structures.

17. A method of spectral analysis of a radio frequency ultrasonic signal returned from a structure subjected to an ultrasound examination, comprising the phases of:

a) transmitting an ultrasonic excitation signal to a portion of said structure subjected to examination;
b) receiving an input radio frequency response signal from said structure;
c) for an input ultrasound frame, producing a sampled and digitized frame;
d) applying a filtering sequence to said sampled and digitized frame to obtain decomposition of the band of the radio frequency response signal into a plurality of frequency bands;
e) producing a matrix of spectral coefficients containing the coefficients resulting from said filtering operation or coefficients deriving therefrom;
f) determining, for at least some of the points of the sampled and digitized frame, respective interpolating polynomials (PI) which approximate the variation of said spectral coefficients in the various bands into which the radio frequency signal was decomposed;
g) for said points, from the coefficients ($a_0,\ldots a_K$) of the interpolating polynomial obtaining a local estimator (c_{ij}), combining at least two

coefficients of different orders (a_0, ...a_k) of the interpolating polynomial with one another.

18. Method as claimed in claim 17, wherein the frequency bands into which said radio frequency signal is subdivided cover the entire frequency band of the signal.

19. Method as claimed in claim 17 or 18, wherein said frequency bands are bands of different width and position.

20. Method as claimed in one or more of claims 17 to 19, wherein said filtering operations are obtained using a time-frequency transform.

21. Method as claimed in claim 20, wherein said time-frequency transform is a wavelet.

22. Method as claimed in claim 20, wherein said time frequency transform is a Discrete Wavelet Packet Transform (DWPT).

23. Method as claimed in one or more of claims 17 to 22, comprising the phase to determine statistical distribution of the local estimators and to create a set of classes of values capable of bi-univocally identifying homogeneous portions on the ultrasound frame of the investigated sample.

24. Method as claimed in one or more of claims 17 to 23, wherein color images produced using said local estimators are overlaid on an ultrasound image.

25. Method as claimed in claim 24, wherein said color images are produced selecting the local estimators that fall within classes of reference, bi-univocally related to predetermined tissue structures.

26. An ultrasound device comprising an ultrasound probe, means to acquire and process a radio frequency return signal from a structure subjected to ultrasound examination, characterized in that said acquisition and processing means are programmed to carry out a method as claimed in one or more of claims 1 to 25.